Assessment of Data Availability and Adequacy for Estimating Contaminant Losses for CAD Cell Alternatives

Reports

Reviewed reports (supplied by the New England District) include:

1. Technical Memorandum, Preliminary CAD Cell Volume Capacity Analysis. 2006. Apex Companies and Jacob Engineering Group.

2. Draft CDF C Groundwater Model Technical Memorandum. 2001. Foster Wheeler Corp.

3. 12-Volume Engineering Feasibility Study. 1988-89. Technical Report EL-88-15, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

4. New Bedford, Sawyer Street Quarterly Groundwater Sampling, Analytical Results, March 1992 - March 2001.

5. Quarterly Sampling at Sawyer Street CDF, October 2004-October 2006. 2006. ENSR/AECOM.

6. Overview of the New Bedford Harbor Physical/Chemical Modeling Program, April 1, 1991 (available at www.epa.gov/ne/nbh).

7. Volumes, Areas and Properties of Sediment by Management Units. 2003. Foster Wheeler report.

8. Dredged Material Management Plan (DMMP) EOEA No. 11669, Draft Environmental Impact Report (DEIR) for New Bedford and Fairhaven, Massachusetts. April 30, 2002. Prepared for Office of Coastal Zone Management, City of New Bedford, MA and Town of Fairhaven, MA. Prepared by Maguire Group Inc., Foxborough, MA.

9. New Bedford Harbor Superfund Pilot Study, Evaluation of Dredging and Dredged Material Disposal. May 1990. U.S. Army Engineer New England Division.

10. Declaration for the Record of Decision, New Bedford Harbor Superfund Site, Upper and Lower Harbor Operable Unit, New Bedford, Massachusetts. September 1998. U.S. Environmental Protection Agency - Region I, New England.

11. Final Sediment Monitoring Summary Report 2006 Remedial Dredging, Environmental Monitoring, Sampling, and Analysis, New Bedford Harbor Superfund Site, New Bedford Harbor, MA. May 2007. Battelle for USACE New England District.

12. Battelle Sediment Data Base.

Other technical reports and background information obtained at:
http://www.epa.gov/ne/nbh/techdocs.html

Modeling Approaches for Modeling Short- and Long-Term Contaminant Losses from Dredged Material Disposal in a CAD Cell

Short-Term Modeling (pre-capping): Processes and Applications of STFATE, SURGE, PSDDF, RECOVERY/CAP and Hydrodynamic Models

Dredged Material Placement: STFATE and SURGE applications

Data Needs: Bathymetry, cell description (size, length, width, depth, side slopes and roughness), density profile, velocity in CAD cell, dredged materials descriptions (water contents, specific gravities, grain size distributions, Atterberg limits, settling characteristics and critical shear velocity as a function of grain size), disposal operation description (barge type, barge size, barge draft, disposal discharge duration per barge, and disposal frequency), standard elutriate tests results and bulk sediment chemistry of sediments particularly for PCBs and copper

Water Column Exchange: Hydrodynamic model application

Data Needs: Calibrated and verified hydrodynamic model and hydrodynamic predictions of exchange rates across opening of CAD cell for range of site conditions (tides, wind, storm, wave and traffic)

Dredged Material Consolidation: PSDDF application

Data Needs: Dredged materials descriptions (water contents, specific gravities, grain size distribution, Atterberg limits, consolidation characteristics from standard oedometer test consisting of void ratio-effective stress relationships for range of dredged materials and void ratio-permeability relationships for range of dredged materials), foundation permeability, regional groundwater model (if foundation is permeable) and pressure head in foundation underlying CAD cell, foundation consolidation properties (if compressible), sediment volumes by type, fill sequence, disposal plan and schedule

Diffusion and Advection of Contaminants from Dredged Material: RECOVERY/CAP application

Data Needs: Bulk sediment concentrations, TOC concentrations, DOC concentrations, specific gravities, water contents, sediment-specific partitioning characteristics, leachable (labile) fractions for copper, groundwater seepage rates through fill, sediment volumes, fill sequence, disposal plan and schedule

Long-Term Modeling (post-capping): Processes and Application of PSDDF and RECOVERY/CAP Models

Dredged Material Consolidation: PSDDF application

Data Needs: Dredged materials and capping materials descriptions [water contents, specific gravities, grain size distribution, Atterberg limits, consolidation characteristics from standard oedometer test consisting of void ratio-effective stress relationships for range of dredged materials and capping materials (if fine-grained) and void ratio-permeability relationships for range of dredged materials and capping materials (if fine-grained)], foundation permeability, regional groundwater model (if foundation is permeable), pressure head in foundation underlying CAD cell, foundation consolidation properties (if compressible), cap design, sediment volumes by type, fill sequence, disposal plan and schedule

Diffusion and Advection of Contaminants from Dredged Material: RECOVERY/CAP application

Data Needs: Cap design, bulk sediment concentrations, TOC concentrations, DOC concentrations, specific gravities, water contents, cap- and sediment-specific partitioning characteristics, leachable (labile) fractions for copper, groundwater/pore water seepage rates through fill, sediment volumes, fill sequence, disposal plan and schedule

DATA NEEDS:

Sediment Data:

Number of materials/classes/types

For each material:
- Volume
- Order of Disposal/Schedule
- Bulk sediment concentration
- Labile fraction
- TOC
- DOC
- Standard elutriate test results
- Partitioning coefficient
- Water content
- Specific gravity
- Grain size distribution
- Atterberg limits
- e-log P relationship
- e-log K relationship

Hydrodynamic/Site Data:

Currents:
- Typical
- Prevailing
- Peak
- Storm

Waves:
- Height
- Frequency or length

Bathymetry:
- Depths
- Tidal ranges

Salinity:
- Profile

Groundwater Data and Foundation Properties (if foundation is permeable or compressible):

Regional groundwater model
Seepage velocity
Pressure head in foundation underlying CAD cell
Foundation permeability
Foundation consolidation properties

Disposal Operation Data and Disposal Plan/Schedule:

Operation description
Sequence of MUs
Production rate
Equipment sizes
Vessel draft
Bucket size
Excavator reach

Cap/CAD Design:

Layers
Thicknesses
Material properties:
- Consolidation
- Permeability
- Specific gravity
- Porosity
- TOC
- Partitioning coefficients

DATA AVAILABILITY AND ADEQUACY			
Parameter	**# of Values**	**Sources**	**Adequacy**
CAD Water PCBs Concentration	3, many during dredging	Technical Report EL-88-15: Report 3; Battelle WQ 2007; 1998 ROD	OK but most data associated with dredging
CAD Water Cu Concentration	3, some during dredging	Technical Report EL-88-15: Report 3; 1998 ROD	OK but most data associated with dredging
Sediment Data	Management Units???		
Sediment PCBs concentration	2 (hot spot and midrange); 57; many others	Technical Report EL-88-15: Report 3 Technical Report EL-88-15: Report 11; Battelle Sediment 2007; 2003 FW Database; 2003 FW Report; 1996 Baseline; 1998 ROD	OK
Sediment Cu concentration	2 (hot spot and midrange); others	Technical Report EL-88-15: Report 3 Technical Report EL-88-15: Report 11; 1996 Baseline; 1998 ROD	OK but need AVS
Pore water PCBs concentration	2 (anaerobic and aerobic midrange)	Technical Report EL-88-15: Report 5 Technical Report EL-88-15: Report 11	Need sampling and testing
Pore water Cu concentration	1 (anaerobic midrange)	Technical Report EL-88-15: Report 5 Technical Report EL-88-15: Report 11	Need sampling and testing
TOC	1 (anaerobic midrange); 57; other OM	Technical Report EL-88-15: Report 3; Battelle Sediment 2007; 2003 FW Report (organic content, not TOC)	OK
DOC	2 (anaerobic and aerobic midrange)	Technical Report EL-88-15: Report 5	Need sampling and testing
Cu labile fraction	Maybe 1 can be estimated	Technical Report EL-88-15: Report 5	Need sampling and testing
Cu partitioning coefficient	Maybe 1 can be estimated	Technical Report EL-88-15: Report 5 Technical Report EL-88-15: Report 9	Need sampling and testing
PCBs partitioning coefficient	Separation sample, Midrange PCB conc composite of Upper Estuary under aerobic and anaerobic conditions	Estes dissertation Technical Report EL-88-15: Report 5	Need sampling and testing

DATA AVAILABILITY AND ADEQUACY (continued)			
Standard elutriate test results	2, hot spot and midrange	Technical Report EL-88-15: Report 3	Need sampling and testing
Water content	1 (midrange composite); numerous moisture contents	Technical Report EL-88-15: Report 3; 2003 FW Report; 1990 NED Report on Evaluation of Dredging Appendix 6-A	OK
Specific gravity	2 (hot spot and midrange); many others	Technical Report EL-88-15: Report 3; 2003 FW Report; 1990 NED Report on Evaluation of Dredging Appendix 6-A	OK
Grain size distribution	2 (hot spot and midrange); 57; many size fractions	Technical Report EL-88-15: Report 3; Battelle Sediment 2007; 2003 FW Report; 1990 NED Evaluation of Dredging Appendix 6-A	OK
Atterberg limits	2 (hot spot and midrange); numerous in 1990 and 2003	Technical Report EL-88-15: Report 3; 2003 FW Report; 1990 NED Evaluation of Dredging Report Appendix 6-A	OK
e-log P relationship		One consolidation test in 1990 NED Evaluation of Dredging Report Appendix 6-A	Need sampling and testing
e-log K relationship			Need sampling and testing
Volume			To be supplied
Order of Disposal/Schedule			To be supplied
Hydrodynamic Data/Model	CAD, RMA-2V and RMA-4; TEMPEST/FLESCOT	Technical Report EL-88-15: Report 2 Battelle 1991	OK, tidal range supplied
Bathymetry Data	limited	Technical Report EL-88-15: Report 2	OK
Density/Salinity Data	limited	Technical Report EL-88-15: Report 2	OK
Groundwater Data/Model			To be examined more closely
Foundation Properties	Incompressible, low permeability till, decomposed bedrock and bedrock	Apex/Jacobs 2006	OK

DATA AVAILABILITY AND ADEQUACY (continued)			
Disposal Operation Data			To be supplied
Disposal Plan/Schedule			To be supplied
CAD Design		Apex/Jacobs 2006	OK
Cap Design			To be determined by modeling

SAMPLING AND TESTING NEEDS:

Annual Dredging Sediment Composites: Seven sediment composites, five in the Upper Harbor and two in the Lower Harbor, should be collected, representing the average of the sediment DMUs to be dredged in each of the years. Care should be taken to collect sufficient samples from each DMU to form each composite so that each composite is representative of the average PCB, Cu, TOC and DOC concentrations, as well as the average water content, silt and clay content, and oil and grease content of the sediment being dredged each year.

Sediment Analysis Needs for Each Composite:
Bulk sediment concentration of Total PCBs (based on 18 PCB congeners as performed for baseline monitoring), Aroclor 1242, Aroclor 1254, Cu, AVS, Oil and Grease, TPHs, and TOC

Pore water total and dissolved concentrations of Total PCBs (based on 18 PCB congeners), Aroclor 1242, Aroclor 1254, Cu, AVS, and Organic Carbon. Also, Salinity, TDS, and TSS

Geotechnical properties including water content, specific gravity, organic content, Atterberg limits, and grain size distribution

Site Water Samples: Site water should be collected from the proposed CAD sites for analysis and use for testing.

Site Water Analysis Needs:
Site water total and dissolved concentrations of Total PCBs (based on 18 PCB congeners), Aroclor 1242, Aroclor 1254, Cu, AVS, Oil and Grease, TPHs, and Organic Carbon. Also, Salinity, TDS, and TSS

Testing Needs:
Standard Elutriate Tests should be run on each of the seven sediment composites using the appropriate proposed CAD site water to predict short-term losses during disposal. The test should analyzed for elutriate total and dissolved concentrations of Total PCBs (based on 18 PCB congeners), Aroclor 1242, Aroclor 1254, Cu, AVS, Oil and Grease, TPHs, Organic Carbon and also TSS.

Sequential Batch Leaching Tests for partitioning characteristics should be run on each of the seven sediment composites to determine partitioning characteristics for PCBs (total based on 18 PCB congeners, Aroclor 1242, and Aroclor 1254) and Cu. Four cycles should be used for PCBs and seven cycles should be used for Cu. The test should analyzed for leachate total and dissolved concentrations of Total PCBs based on 18 PCB congeners, Aroclor 1242, Aroclor 1254, Cu, AVS, Oil and Grease, TPHs, Organic Carbon and also TSS.

Standard Oedometer Consolidation (ASTM D2435) and Permeability Tests should be run on each of the seven sediment composites to determine consolidation properties for consolidation of the dredged material in the CAD sites and for seepage of pore water from the CAD sites.